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**School of Engineering and Computer Science**

# ECE 325: Electronic Devices and Applications
# Master Syllabus

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| ***Catalog Data:*** | **ECE 325: Electronic Devices and Applications**; 4 credits (3-3)<br>MOS small and large signal models, bipolar transistors, biasing and parasitics, amplifier design and feedback, frequency response; circuit simulation and device models. Typically offered in Fall. |
| ***Class Schedule:*** | Three lecture hours per week, for one semester. |
| ***Laboratory Schedule:*** | One 3-hour lab session, for one semester. |
| ***Prerequisites by Course:*** | ECE 214, ECE 260 |
| ***Prerequisites by Topic:*** | 1. Understanding of electric circuit theory, modeling and analysis.<br>2. Understanding of digital logic circuit design. |
| ***Typical Texts:*** | R. L. Boylestad, L. Nashelsky, *Electronic Devices and Circuit Theory, 11/e*, Prentice Hall 2012, ISBN: 978-0-13-262226-4<br>R. L. Boylestad, L. Nashelsky, *Lab Manual to accompany electronic devices and circuit theory, 11/e,* Prentice Hall 2012, ISBN: 978-0-13-262245-5 |
| ***Course Coordinator:*** | Dr. John Lynch |
| ***Course Objectives:*** | Students will:<br>1. Understand, measure, and utilize the terminal characteristics of diodes, bipolar junction transistors (BJTs), and metal oxide silicon field effect transistors (MOSFETs).<br>2. Design and analyze single-stage amplifiers using BJTs and MOSFETs. |
| ***Topics Covered:*** | 1. Ideal diode and analysis of diode circuits<br>2. Diode models: Schockley's equation, piecewise-linear models<br>3. Analysis of diode circuits based on non-ideal models<br>4. Zener and light-emitting diodes<br>5. Diode applications: rectifier circuits, Zener voltage regulators, etc.<br>6. Temperature effects<br>7. Physical operation and characteristics of enhancement-mode NMOS and PMOS transistors, modes of operation<br>8. MOS transistor circuits at DC<br>9. MOS transistor as a switch and as an amplifier<br>10. Small-signal MOS model<br>11. MOS transistor amplifiers; common-source, common-drain, and common-gate single-stage configuration; two-stage amplifiers; differential amplifiers<br>12. BJT physical operation and characteristics of NPN and PNP transistors, modes of operation<br>13. BJT circuits at DC<br>14. BJT as a switch and as an amplifier<br>15. Hybrid-pi small-signal model<br>16. Single-stage BJT amplifiers, comparison of BJT and MOS transistors<br>17. Frequency response of BJT and MOS devices. |

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| ***Lab Experiments and Activities:*** | | Topics covered will be converted into laboratory sessions as needed to measure, analyze, and design diode, BJT, and MOSFET circuits. These activities are translated into -but not limited to- the following experiments:<br><br>1. Diode characteristics<br>2. Diode clipping/clamping circuits<br>3. Light-emitting and Zener diodes<br>4. BJT characteristics<br>5. BJT bias circuits<br>6. BJT amplifier circuits<br>7. JFET characteristics<br>8. JFET bias circuits<br>9. JFET amplifier circuits<br>10. Frequency response of BJT and FET amplifier circuits | | |
| ***Course Outcomes:*** | Students will be able to: | | | |
| | ***Assessed for Student Outcomes*** | 1-c. Use appropriate models to formulate solutions for electronic devices and applications.<br>6-a. Identify constraints, assumptions, and models for electronics experiments.<br>6-c. Conduct analysis and interpretation of the data from electronics experiments.<br>6-d. Draw conclusions by evaluating experimental results with respect to theory. | | |
| | ***Other*** | 1-a. Demonstrate knowledge of fundamental electronic device principles.<br>1-d. Apply mathematics, scientific and/or engineering principles toward solving electronics problems.<br>2-b Apply design process to satisfy project requirements for electronic systems.<br>6-b. Use appropriate equipment and techniques for electronic experiments. | | |
| ***Relationship of Course to Program:*** | | Meets: Educational Objectives 1, 2<br>Student Outcomes 1, 2, 6 | | |
| ***Prepared by:*** | | Dr. John Lynch | Date: | December 30, 2009 reviewed 02/12, reviewed 9/4/12, revised 09/17, revised 03/2018; 3/21/18 (mb) |